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FAMILY LYCEUM.

JOSIAH HOLBROOK, EDITOR.

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SELF-MADE MEN.

From Edwards' Biography of Self-Made Men.

SIR HUMPHREY DAVY.

HUMPHREY DAVY was born in 1778, at Penzance in Cornwall, England. His father followed the profession of a carver in wood, in that town, where many of his performances are still to be seen in the houses of the inhabitants. All that we are told of Davy's school education is, that he was taught the rudiments of classical learning at a seminary in Truro. He was then placed, by his father, with an apothecary and surgeon in his native place. But instead of attending to his profession, he spent his time, either in rambling about the country, or in experimenting in his master's garret, sometimes to the no small danger of the whole establishment. The physician and Davy at last agreed to part.

When rather more than fourteen years old, he was placed as pupil with another surgeon, residing at Penzance; but it does not appear that his second master had much more success than the first in attempting to give him a liking for the medical profession. The future philosopher, however, had already begun to devote himself, of his own accord, to those sciences in which he afterwards so greatly distinguished himself; and proceeding upon a plan of study which he had laid down for himself, he had, by the time he was eighteen years old, obtained a thorough knowledge of the rudiments of natural philosophy and chemistry, as well as made some proficiency in botany, anatomy, and geometry. The subject of metaphysics, it is stated, was also embraced in his reading at this period.

But chemistry was the science to which, of all others, he gave himself with the greatest ardor; and, even in this early stage of his researches, he seems to have looked forward to reputation from his labors in this department. 'How often,' said he, in the latter period of his life, 'have I wandered about those rocks in search after new minerals, and when tired, sat down upon those crags, and exercised my fancy in anticipations of future renown.' The peculiar features of this part of the country doubtless contributed not a little to give his genius the direction it took. The mineral riches concealed under the soil formed alone a world of curious investigation. The rocky coast presented a geological structure of inexhaustible interest. Even the various productions cast ashore by the sea, were continually affording new materials of examination to his inquisitive and reflecting mind. The first original experiment, it is related, in which he engaged, had for its object to ascertain the nature of the air contained in the bladders of sea-weed. At this time he had no other laboratory than what he contrived to furnish for himself, by the assistance of his master's phials and gallipots, the pots and pans used in the kitchen, and such other utensils as accident threw in his way. These he converted, with great ingenuity, to his own purposes. On one occasion, however, he accounted himself particularly fortunate in a prize which he made. This was a case of surgical instruments with which he was presented by the surgeon of a French vessel which had been wrecked on the coast, to whom he had done some kind offices. Examining his treasure with eagerness, Davy soon perceived the valuable aid he might derive in his philosophical experiments, from some of the articles. One of the principal of them was, in no long time, converted into a tolerable air-pump. The proper use of the instruments was, of course, as little thought of by their new possessor as that of his master's gallipots which he was wont to carry up to his garret. Davy's subsequent success as an experimentalist, was owing, in no small degree, to the necessity he was placed under, in his earliest researches, of exercising his skill and ingenuity in this manner. 'Had he,' remarks his biographer, 'been supplied, in the commencement of his career, with all those appliances, which he enjoyed at a later period, it is more than probable that he might have never acquired that wonderful tact of manipulation, that ability of suggesting expedients, and of contriving apparatus so as to meet and surmount the difficulties, which must constantly arise, during the progress of the philosopher through the unbeaten tracks and unexplored regions of science. In this art, Davy certainly stands unrivalled; and like his prototype, Scheele, he was unquestionably indebted for his address to the circumstances, which have been alluded to. There was never, perhaps, a more striking exemplification of the adage that 'necessity is the parent of invention.'

Davy first pursued his chemical studies, without teacher or guide, in the manner which has been described, and aided only by the most scanty and rude apparatus. When still a lad, however, he was fortunate in becoming acquainted with Mr. Gregory Watt, son of the celebrated James Watt. This gentleman, having come to reside at Penzance for the benefit of his health, lodged with Mrs. Davy, and soon discovered the talent of her son. The scientific knowledge of Mr. Watt, gave an accurate direction to the studies of the young chemist, and excited him to a systematic perseverance in his favorite pursuit. He was also providentially introduced to the notice of Mr. Davies Gilbert, since President of the Royal Society. The boy, we are told, was leaning on the gate of his father's house, when Mr. Gilbert passed, accompanied by some friends, one of whom remarked, that there was young Davy who was so much attached to chemistry. The mention of chemistry immediately fixed Mr. Gilbert's attention; he entered into conversation with the young man, and, speedily becoming convinced of his extraordinary talents and acquirements, offered him the use of his library, and whatever other assistance he might require for the pursuit of his studies. Mr. Gilbert and Mr. Watt soon after this, introduced Davy to the celebrated Dr. Beddoes, who had just established at Bristol what he called his Pneumatic Institution, for investigating the medical properties of the different gasses. Davy, who was now in his nineteenth year, had for some time been thinking of proceeding to Edinburgh, in order to pursue a regular course of medical education; but Dr. Beddoes, who had been greatly struck by different proofs which he had given of his talents, and especially by an essay in which he propounded an original theory of light and heat, having offered him the superintendence of his new institution, he at once accepted the invitation. 'The young philosopher,' remarks a biographer, 'was now fairly entered upon his proper path, and, from this period, we may consider him as having escaped from the disadvantages of his early lot. But it was while he was yet poor and unknown, that he made those acquirements, which both obtained for him the notice of his efficient patrons, and fitted him for the situation in which they placed him. His having attracted the attention of Mr. Gilbert, as he stood at his father's gate, may be called a happy incident in the providence of God; but it was one that never would have happened had it not been for the proficiency he had already made in science by his own endeavors. He had this opportunity of emerging from obscurity; but had he not previously labored in the cultivation of his mind as he had done, it would have been no opportunity at all.'

The experiments conducted by Davy, and under his direction, at the Bristol Institution, were soon rewarded by important results; and of these, Davy, when he had just completed his twenty-first year, published an account, under the title of 'Researches Chemical and Philosophical, chiefly concerning Nitrous Oxide, and its respiration.' In this publication, the singularly intoxicating effects produced by the breathing of nitrous oxide, was first announced. This announciation excited considerable sensation in the scientific world, and at once made Davy generally known as a most ingenious and philosophic experimentalist. He was, in consequence, soon after its appearance, invited to fill the chemical chair of the Royal Institution, then newly established. When he commenced his lectures, he was scarcely twenty-two years of age; but never was success in such an undertaking more marked and gratifying. He soon saw his lecture rooms crowded, day after day, by all that was most distinguished in the rank and intellect of the metropolis; and his striking and beautiful elucidations of every subject that came under his review, rivetted, often to breathlessness, the attention of his splendid auditory. The year after his appointment to this situation he was elected professor of chemistry to the Board of Agriculture; and he greatly distinguished himself by the lectures which for ten successive sessions, he delivered in this character. They were published in 1813, at the request of the Board. In 1816, he was chosen to deliver the Bakerian lecture before the society; and he performed the same task for several successive years. Many of his most brilliant discoveries were announced in these discourses. In 1812, he received the honor of knighthood from the Prince Regent, being the first person on whom his Royal Highness conferred that dignity. Two days after he married a lady of considerable fortune. In 1813, he was elected a corresponding member of the French Institute. He was created a baronet in 1818. In 1820, he was chosen a foreign associate of the Royal Academy of Sciences, at Paris, on the death of the illustrious Watt. He had been, for some time, Secretary of the Royal Society; and on the death of Sir Joseph Banks, in 1820, he was, by an unanimous vote, raised to the presidency of that learned body—an office which he held till he was obliged to retire, on account of ill health, in 1827, when his friend and first patron, Mr. Davies Gilbert, was chosen to succeed him. Little, we may suppose, did either of the two anticipate, when they first met, thirty years before, at the gate of Mrs. Davy, that they would thus stand successively, and in this order, at the head of the most distinguished scientific association in England.

AMERICAN FOREST TREES.

The subject of Natural History, as a branch of *common education*, has recently been discussed before several conventions of teachers, where it was uniformly and warmly recommended. It is already introduced into infant schools, where it is a 'prominent and delightful subject, and the way seems to be fast preparing for its introduction into district and other common schools.

Geology, which was lately unknown in our colleges, is now taught in numerous schools in various parts of the country, where it is a subject of delightful amusement, no less than of useful knowledge. Children, almost immediately after the subject is introduced to them, become as familiar with the names, ingredients, properties and uses of all the rocks around them, and with many other minerals, as they are with the common articles of table furniture. Their pockets, shelves, and chambers, which are soon loaded with specimens, afford the most satisfactory proof of their industry, as well as of their interest and knowledge in this practical science.

The researches of these young explorers have not unfrequently been rewarded with valuable discoveries, not merely to enrich their collections, but to increase the wealth of the country, and to advance the useful arts.

Botany has, for years, been more or less a subject of instruction, especially in female seminaries, and in classes collected expressly for hearing lectures on that science. It has recently been introduced to the attention of children, to whom, like every other branch of natural history, it is particularly agreeable. This, like geology, must, at no distant period, become a branch of common education.

From some cause, which it would not, perhaps, be easy to explain, one subject of Botany has hitherto been almost wholly neglected, both by teachers, and the amateurs of science—the *American Forest Trees*, which foreigners inform us, present the grandest object in the vegetable kingdom. It is not greatly to the credit of American science, that the best and almost the only account we have of our own forests, is from two gentlemen from France, who visited this country for the express purpose of examining this interesting department of nature.

These gentlemen inform us, that in this country, one hundred and thirty trees grow over thirty feet in height; while in France, only thirty-seven rise to an equal elevation, and that but a part of these are natives of their forests.

They have named and described forty-four different kinds of oaks which they examined. The different species of this genus possess almost every variety of character. They differ greatly in their elevation, texture, strength and durability of timber, shape, size and taste of fruit, color, form and size of leaf, and every other property belonging to wood. While one species is among the most lofty of the trees which tower in our forests, rising to the height of an hundred feet, another seldom rises more than twenty inches above its surface. The timber of one is almost as hard and durable as iron, while that of another is so loose and open in its texture, as to be classed among the soft woods. The acorns of some oaks are large, extending far out of their cups, palateable to some animals, and even much esteemed by the natives, and are very abundant; while others are small, nearly covered by their envelope, of a bitter taste, with but here and there one upon a tree. The leaves of some are small, others large; some smooth, others deeply indented; some of a dark green, others of a light complexion.

The white oak is the most valuable species in this genus, both in Europe and America. Indeed white oak timber is applied to a greater variety of uses than any other vegetable substance produced upon our globe. Shipbuilders, carpenters, manufacturers of agricultural implements, coopers, and numerous other mechanics, find this material nearly indispensable in pursuing their arts. Next to walnut, it is also the most valuable wood for fuel.

This tree has a very extensive range, growing in this country from Vermont and New-Hampshire to Florida.

The live oak has some singular and highly valuable properties, but has a less extensive range and is less abundant than many other species, being confined to the southern districts of the United States and the northern of Mexico. It is exceedingly tight and hard, and this quality, with the branching limbs, of almost every possible shape, fits it for shipbuilding, for which it is extensively employed, especially in our navy.

Next to the oak, the walnut is the most extensive genus in our forests. In this genus are found two classes, somewhat distinct: the one comprehending the black walnut and butternut; the other all that species known by the general name of hickory.

The two first differ from all other species of walnut in their timber, leaves and fruit, in all of which they resemble each other. The timber of both is used for many kinds of cabinet work, but the butternut is less valuable for that use than the walnut. The last is almost the only material used for gunstocks, for which purpose it is carried to the different armories in the country. It is procured from Pennsylvania, where it is a native, and grows in abundance. This tree is not known to be a native of New-England, but whenever it is transplanted here from the south, it grows with luxuriance and beauty, and is probably worthy of more extensive cultivation.

The fruit of the black walnut is of a globular shape, inclosed in a husk without incisions, unlike that which envelopes the nuts of the more numerous class under the name of hickory. The husk of the butternut, is also like that of the black walnut, wholly connected, and is not removed except by fracture. The shape of the butternut every one knows to be oval.

The shagbark walnut is the most valuable of the largest class of this genus, both for timber and fuel. For the latter it is more valuable than any other tree growing in the northern or middle states.

Next to the oaks and walnuts, maples, birches, ashes, elms, chesnuts and beeches are among the most interesting trees in American forests.

From Mitchell's Encyclopædia.

CLOUDS.

A Cloud is a mass of vapor, more or less opaque, formed and sustained at considerable heights in the atmosphere, probably by the joint agencies of heat and electricity. The first successful attempt to arrange the diversified forms of clouds, under a few general modifications, was made by Luke Howard, Esq. We shall give here a brief account of his ingenious classification.

The *simple* modifications are thus named and defined: 1. *Cirrus.* Parallel, fluxious, or diverging fibres, extensible in any or in all directions. 2. *Cumulus.* Convex or conical heaps, increasing upwards from a horizontal base. 3. *Stratus.* A widely extended, continuous horizontal sheet, increasing from below.

The *intermediate* modifications which require to be noticed are, 4. *Cirro-cumulus.* Small, well-defined roundish masses, in close horizontal arrangement. 5. *Cirro-stratus.* Horizontal, or slightly inclined

masses, attenuated towards a part of the whole of their circumference, bent downward, or undulated, separate or in groups, consisting of small clouds having these characters.

The *compound* modifications are, 6. *Cumulo-stratus.* The cirro-stratus, blended with the cumulus, and either appearing intermixed with the heaps of the latter, or superadding a wide-spread structure to its base.

7. *Cumulo-cirro-stratus*, vel *Nimbus.* The rain cloud. A cloud or system of clouds from which rain is falling. It is a horizontal sheet, above which the cirrus spreads, while the cumulus enters it latterally and from beneath.

The *cirrus* appears to have the least density, the greatest elevation, the greatest variety of extent and direction, and to appear earliest on serene weather, being indicated by a few threads pencilled on the sky. Before storms they appear lower and denser, and usually in the quarter opposite to that from which the storm arises. Steady high winds are also preceded and attended by *cirrus* streaks, running quite across the sky in the direction they blow in.

The cumulus has the densest structure, is formed in the lower atmosphere, and moves along with the current next the earth. A small irregular spot first appears, and is, as it were, the nucleus on which they increase. The lower surface continues irregularly plane, while the upper rises into conical or hemispherical heaps; which may afterwards continue long nearly of the same bulk, or rapidly rise into mountains. They will begin, in fair weather, to form some hours after sunrise, arrive at their maximum in the hottest part of the afternoon, then go on diminishing and totally disperse about sunset. Previous to rain, the cumulus increases rapidly, appears lower in the atmosphere, and with its surface full of loose fleeces, or protuberances. The formation of large cumuli to the leeward in a strong wind, indicates the approach of a calm with rain. When they do not disappear or subside about sunset, but continue to rise, thunder is to be expected in the night. The *stratus* has a mean degree of density, and is the lowest of clouds, its inferior surface commonly resting on the earth or water. This is properly the cloud of night appearing about sunset. It comprehends all those creeping mists, which in calm weather ascend in spreading sheets, (like an inundation of water,) from the bottom of valleys, and the surfaces of lakes and rivers. On the return of the sun, the level surface of this cloud begins to put on the appearance of cumulus, the whole at the same time separating from the ground. The continuity is next destroyed, and the cloud ascends and evaporates, or passes off with the appearance of the nascent cumulus. This has long been experienced as a prognostic of fair weather.

The *cirrus* having continued for some time increasing or stationary, usually passes either to the cirro-cumulus or to the cirro-stratus, at the same time descending to a lower station in the atmosphere. This modification forms a very beautiful sky; is frequent in summer, and attendant on warm and dry weather. The *cirro-stratus*, when seen in the distance, frequently gives the idea of shoals of fish. It precedes wind and rain; is seen in the intervals of storms; and sometimes alternates with the cirro-cumulus in the same cloud, when the different evolutions form a curious spectacle. A judgment may be formed of the weather likely to ensue by observing which modification prevails at last. The solar and lunar *halos*, as well as the parhelion and paraselene, (mock sun and mock moon,) prognostics of foul weather, are occasioned by this cloud. The cumulo-stratus precedes, and the nimbus accompanies rain.

Burning Coal Mine.

It is now more than two years since the snow lying on a field on the farm of Shaw Park, belonging to the Earl of Mansfield, was observed to melt almost as soon as it fell, and then rise in a state of vapor. The phenomenon attracted the attention of the managers of the Alloa and Devon collieries, and was found to be the effect of the heat produced by a stratum of coal in a state of ignition, technically known by the name of the nine feet seam, from which the Devon iron works are supplied with a large portion of their fuel. Various plans were at the same time suggested to extinguish the flames, and after several failures, it was determined to cut a mine round the seam to prevent their extension. Workmen were set to excavate this mine, which was opened at both sides of the seam, to build a wall as they proceeded, on the sides of the two tunnels next the fire. In this way it was intended to proceed, till the tunnels penetrated beyond the fire, when they were to be joined in the form of a horse shoe, and thus cut off, by means of a strong wall, all connexion between the ignited part of the seam and the remainder of it. This plan has been persevered in for a year and a half, but has never been completed. The workmen have often brought two walls within a few fathoms of meeting, but owing to the fire bursting in upon them, they have been hitherto obliged to fall back again and to take a wider circle. Six or seven shafts have been sunk to ventilate the tunnels, in which the heat is frequently so great as to raise the thermometer from 212 to 230 degrees Fahrenheit;—it sometimes rises even higher. The lamps of the miners which are hung upon the walls, have more than once fallen to pieces from extreme heat.

GEOLOGY.

GNEISS.

The citizens and visiters of New-Orleans would be much more annoyed with mud than at present, were it not for a quarry of stone on the banks of the Connecticut, in the town of Haddam, a short distance below Middletown. Besides the stone which already forms many of their side walks, a yard in the city contains many hundred tons designed for the same use and taken from the same place.

Other southern cities are accommodated with the same useful solid material, procured from the same exhaustless quarry. A person cannot walk far on the sidewalks in Philadelphia, without recognizing the same old solid and tried friend from Connecticut. In New-York and New-Haven, this same friend meets the eye of a traveller almost every step he takes.

Hundreds, and probably thousands of houses are resting upon this antediluvian friend for their foundation. Many thousand travellers have trusted to it in bridges of which it constitutes very many in all parts of New-England.

This same old friend has been tried for six thousand years, and has never been found to be one of those which the wise man of old declares is like a rotten tooth, or a foot out of joint. It is always faithful to its trust. It never lets a building fall which trusts to it for support. All travellers have occasion to speak well of it as a bridge, for it never fails to carry them safely over. When farmers trust to it to protect their gardens and fields, their crops are never destroyed. It is indeed an old friend: a true friend; and a friend always at hand. It makes its appearance, and stands waiting, at almost every high way in a large majority of the tows in New-England and the Atlantic states.

When it was said to the original chaotic ocean, 'let dry land appear,' granite was the first, and gneiss the second, among the innumerable solid masses now upon the earth which obeyed the command. There is much reason to believe, that to some extent they made their appearance together. They are almost always associated, or are contiguous to each other, and are composed of the same ingredients. They are both composed of the three simple minerals already described in the Lyceum, viz. quartz, felspar, and mica. Their principal difference is in the proportion and arrangement of these ingredients.

Granite has usually more felspar than the gneiss, and is coarser and more irregular in its structure. In granite the mica is scattered promiscuously in every possible direction through the rock; while in gneiss it is arranged in one direction, and hence gives the rock a slaty structure. So that gneiss may not improperly be called slaty granite.

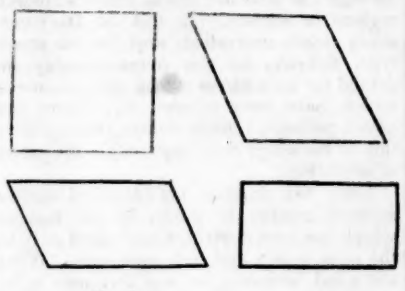
The difference in the structure of these two rocks, leads to different modes of working them. By two or three wedges, slabs of gneiss can be split of a great length and with great regularity; while granite can be split only by drilling holes a few inches apart, through the whole distance the fracture is to be made, which are to be followed by wedges drove gradually till a rent is made through the whole mass, which is sometimes a hundred, or perhaps several hundred feet in length and as many in depth.

As gneiss breaks with greater regularity and a smoother surface than granite, it requires less hammering after it is broken; hence it is extensively used for sidewalks, floors, bridges, &c., with the same surface that it receives in its original fracture, while granite is scarcely fit for any of these uses until it is hammered.

As granite and gneiss are the two oldest rocks, and the oldest solid materials upon our earth, and almost universally diffused over its surface, constituting as they do the highest peaks and the lowest beds of mountains, as they are more than other materials the origin of soils, and as they are constantly resorted to for works of architecture and civil engineering, and promote our happiness in numberless and nameless forms, they deserve more of the acquaintance of those upon whom they are bestowing so many favors than they possess.

GEOMETRY.

PARALLELOGRAMS AND PARALLELOPIPEDS.



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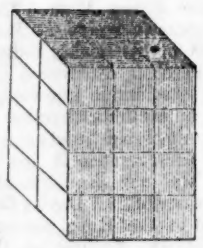

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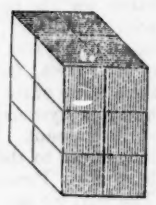

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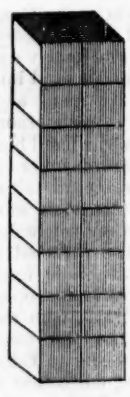

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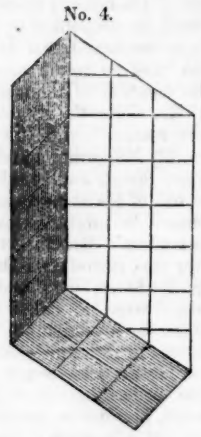

The beauty of creation depends in no small degree upon the endless variety of figure we witness in objects around us. How much of the grandeur of a forest would be lost, nay, how monotonous it would be, if every tree was of the same size, and every leaf of the same shape. How much of the beauty of a flower-garden would take its departure, if all the plants which adorn it presented the same appearance to their admirers. How much of the beauty of minerals depends upon the variety of their crystals, structure, color, &c. What would become of the beauty of the animal kingdom, if all quadrupeds, all birds, all fishes, and all insects, were reduced to the same form?

It is not variety merely that gives either beauty or utility to the objects our Creator has put into our hands. In the midst of variety there is regularity; and under the greatest apparent disorder and confusion in the works of the Great Architect of Creation, there is order; and in the wildest and most violent commotions of nature, there is the strictest obedience to the ordinances of the Great Lawgiver.

The object of Geometry is to discover and apply the elements, the original principles, the uniform laws, which regulate this endless and beautiful variety of shape or figure in the worlds and objects which surround us.

One instance of uniformity and regularity amidst this endless variety of figure, is in parallel lines, bounding both surfaces and solids. All surfaces which are bounded by parallel lines, especially all four-sided figures, are much more easily measured, and much more easily applied to various purposes in the common arts, than those with oblique lines. All figures thus bounded, or those enclosed in four lines, with the opposite parallel, our readers, even our juvenile patrons, are aware are *parallelograms.*

Not only surfaces but solids, are sometimes bounded by parallel lines, in other words, they are wholly enclosed in parallelograms, and are hence denoted by as long, as ugly, and as hard a name as the one just mentioned, and which we should be very glad to exchange for a better; but until we can find a better, and get others to agree to it, we must continue to use that long, hard, ugly word, difficult to spell and to speak, which we put at the head of an article in the last Lyceum. It is *parallelopiped*, variously pronounced and spelled; and it would seem that every one ought to have full liberty to spell and pronounce it as he pleases, or not at all. But if we analyse it as fixed by that most cruel of all tyrants, *fashion*, we shall find that it has three *l*s, three *p*s, two *a*s, two *e*s, one *d*, one i, and one *r*, with the accent on the *i*.

In the cuts connected with this article, all the parallelograms are represented; of which there are but four different kinds. The parallelopipeds are much more numerous, and a few of them were represented in the last Lyceum, and four others are given in this. By examining them it will be seen, that in No. 4 two of the sides are rhomboids, which give to the solid two acute and two obtuse angles or edges. Two sides of a parallelopiped may be rhombuses, but the remaining four must be either squares or oblongs. This and many other principles respecting this very interesting and important class of solids, will be much more clearly understood by looking at the solids themselves, as they are prepared in the apparatus both for schools and families.

By examining those solids, it will be seen what steps must be taken to find the contents of a pile of wood, timber, brick, or granite; the contents of a cistern, bin, room, box, &c. &c. as may be needed in various kinds of business.

We can hardly refrain from again presenting the elements of Geometry, as more fundamental and absolutely essential in a course of scientific or practical instruction, than any other subject which can be named; and that being the case, it is truly gratifying to learn from teachers and parents in all parts of the country, that where it is presented to children with the aid of apparatus, it is their most delightful amusement; and we cannot but believe, that in Lyceums, or Circuit Schools, Academies and High Schools, no less than in Infant and Primary Schools, it is highly appropriate, as the beginning and ground-work of the whole fabric.

The Bible.

For mental philosophy—for the powers, propensities, interests and destinies of intellects and hearts—the Bible is unquestionably better than any other or all other books.—Lock, Stewart, Edwards, Reid, Brown, Mason, and Paley, united, do not contain so much common sense, they do not give that insight into the soul of man, they do not delineate his character as it is constantly exhibited before our eyes, they do not contain so much sound intellectual and moral philosophy, as the books of the Old and New Testament.

For the science of man—for *physical, intellectual, social, moral, religious* man—which has more dignity, more grandeur, more sublimity, more utility, and more hope, than Astronomy, Chemistry, Natural Philosophy, Botany, Mineralogy, or all of them united, The Bible, aided by observation, and a minute examination of the subjects themselves, ought to be the text-book from first to last: with the child of three years old, and with the man of gray hairs; with the poor man and the rich man; with the farmer at his plow, and the mechanic at his bench; with the astronomer in his observatory, and the chemist in his laboratory; with the husband and the wife, the father and son, the mother and daughter; with the teacher and pupil; with the ruler and the ruled, the President and the Governor, the *ins* and the *outs*, the statesman and the patriot, the philanthropist and the christian.

From Mitchell's First Lines of Science.

Rain.

Mr. Luke Howard, who may be considered as our most accurate scientific meteorologist, is inclined to think, that rain is in almost every instance the result of the electrical action of the clouds upon each other. This idea is confirmed by observations made in various ways upon the electrical state of clouds and rain; and it is very probable that a thunder-storm is only a more sudden and sensible display of those energies, which, according to the order observable in the creation in other respects, ought to be incessantly and silently operating for more general and beneficial purposes.

The excess, for any given time, of the falling water over that which is evaporated, passes off by the springs and rivers to that grand reservoir which forms the far greater part of the surface of the globe. Tracts of forests, especially if mountainous, invite the rain, and protect the springs; while the accumulated heat on cultivated plains often causes the clouds to pass over them, or to be dissipated.

The quantity of rain, taken at an annual mean is the greatest at the equator, and it decreases gradually to the poles; but there are fewer days of rain there, the number of

which increase in proportion to the distance from it. From north latitude 12 deg. to 43 deg. the mean number of rainy days is 78; from 43 deg. to 46 deg. the mean number is 103; from 46 deg. to 50 deg. 134; and from 51 deg. to 60 deg. 161. Winter often produces a greater number of rainy days than summer, though the quantity of rain is more considerable in the latter than in the former season. Mountainous districts are subject to great falls of rain; among the Andes particularly it rains almost incessantly; while the flat country of Egypt is consumed by almost endless drought. The rain guage affords reason to suppose, that a greater quantity of rain falls in the lower strata of the atmosphere than in those above, which may be accounted for by the drops attracting vapour in their near approach to the earth. Mr. Copland, of Dumfries, has, however, discovered the rain collected in the lower guage was greatest when it continued falling for some time, and that the greatest quantity was collected in the higher during short rains, or at the conclusion of lengthened ones.

As rain is known to fall at all hours of the day and night, and at every season of the year, it is apparent that it is caused by operations which prevail eternally, and without defined interruption. The mean annual quantity of rain for the whole globe has been calculated to be about 34 inches. The superficies of the globe consist of 170,981,012 square miles, or 686,401,498,471,475,200 square inches; the quantity of rain therefore falling annually, will amount to 23,337,650,812,030,156,800 cubic inches, or somewhat more than 91,751 cubic miles of water. There are 52,745,253 square miles of dry land on the globe; consequently the annual amount of the quantity of rain descending upon it will be 30,960 cubic miles.

The quantity of water running annually into the sea is 13,140 cubic miles; a quantity of water equal to which must be supplied by evaporation from the sea, otherwise the land would soon be completely drained of its moisture.

The quantity of rain falling annually in Great Britain may be seen from the following table: which is probably the most extensive of the kind; and as accurate as the use of instruments, not constructed by one person, and adjusted to a common standard, will allow. It is mostly compiled from the transactions of different learned societies.

Counties (maritime.)	Places.	Mean ann. depth in inches.
Cumberland	Keswick, 7 years	67. 5
	Carlisle, 1 year	20. 2
Westmoreland	Kendall, 11 years	59. 8
	Fell-foot, 3 years	55. 7
	Waith Sutton, 5 years	46.
Lancashire	Lancaster, 10 years	45
	Liverpool, 18 years	34. 4
	Manchester, 9 years	33
	Townley	41
	Crawshawbooth, near Haslingdon, 2 years	60
Gloucestershire	Bristol, 3 years	29. 2
Somersetshire	Bridgewater, 3 years	29. 3
Cornwall	Ludguan, near Mount's Bay, 5 years	41
	Another place, 1 year	29. 9
Devonshire	Plymouth, 2 years	46. 5
Hampshire	Selbourne, 9 years	37. 2
	Fyfield, 7 years	25. 9
Kent	Dover, 5 years	37. 5
Essex	Upminster	19. 5
Norfolk	Norwich, 13 years	25. 5
Yorkshire	Barrowby, near Leeds, 6 years	27. 5
	Garsdale, near Sedbergh, 3 years	52. 3
Northumberland	Widdrington, 1 year	21. 2

Counties (inland.)	Places.	Means.
Middlesex	London, 7 years	23
Surry	South Lambeth, 9 years	22. 7
Hertfordshire	Near Ware, 5 years	25
Huntingdonshire	Kimbleton, 7 years	25
Derbyshire	Chatsworth, 15 years	27. 8
Rutlandshire	Lyndon, 21 years	24. 3
Northamptonshire	Near Oundle, 14 years	23
	General mean,	35. 2

As the places subject to much rain predominate considerably in this list, it will probably be nearer the truth, if we take the mean annual rain in England and Wales at a quantity not exceeding 32 inches.

In this country it generally rains less in March than in November, in the proportion, at a medium, of 7 to 12. It generally rains less in April than October, in the proportion of 1 to 2, nearly at a medium. It generally rains less in May than September; the chances that it does so are at least 4 to 3: but when it rains plentifully in May, (as 1.8 inches or more,) it generally rains but little in September; and when it rains one inch or less in May, it rains plentifully in September.

Ladies.

There is, perhaps, scarcely a more striking or more interesting feature in this very peculiar age of the world, than the active, persevering and efficient efforts made by ladies in the cause of education and of benevolence. It is a most fortunate circumstance that infant schools have, from the commencement, been in a great measure, committed to their charge. They could not, or would not otherwise have been sustained and advanced in their character and usefulness. The system of kindness, patience, discretion and perseverance necessary to conduct and continue these schools, can hardly be expected from any other source.

Various works of benevolence, for which their dispositions and their situations are peculiarly fitted, have seldom, if ever, failed to prosper, when committed to the hands of ladies. The soul, the animation, the energy and the perseverance which they almost uniformly bring to bear on these works so consonant to their nature, cannot but ensure success. When one expedient fails, their ingenuity and ardor in a good cause finds quick resort to another and another.

We have long wished to see two objects more committed to their charge; at least to receive the benefit of their efforts; we mean the poor children of our cities and our primary schools, especially in the summer. We do not mean as teachers merely, but as visiters, advisers, and encouragers of teachers. We shou d like to see in the good city of Boston, a society of two hundred, or five hundred ladies formed, whose object it would be, to find out the wants of every child, and to put in operation means to supply them. We should like to see the city divided into twenty or thirty wards or sections, and each committed to some twenty or thirty ladies, to provide instruction, especially to the proper subjects of infant schools, until it might be said, that no child in the city was in want of instruction or of bread. Such a society engaged in such an object, would do more to prevent poverty and crime, by every five dollars they should expend for it, than five thousand dollars would do, expended upon alms houses, courts of justice, prisons, sheriffs and all the other legal provisions that ever have been, or ever can be devised.

The same measures which will answer in Boston, will answer in New York, Philadelphia, Baltimore, Washington, Charleston, New Orleans, Cincinnati, and all other cities in our Union.

The other step we wish to see taken by American ladies, is an oversight, or a visitership of our primary schools, especially the public schools throughout New England. If a dozen ladies in each town should unite in such an object, and invite their teachers to meet with them, and make arrangements for visiting their schools in succession, and should take measures to animate the children, and encourage the teachers, every school in the country thus visited and encouraged, would be worth double at least of what it would be under the ordinary, dull, monotonous, lifeless, senseless course of management to which they are subject.

We hope and we know that our ladies will not be offended, if we invite their attention to these two most interesting and benevolent objects.

We beg leave also to invite the attention of ladies to some intelligent and practical views on this subject under the head of cholera, in a late number of their invaluable magazine, in the hands of Mrs. Hale. When reading that article we were particularly struck with the perfect coincidence of the views there expressed, with those we had long entertained on the subject, though we had never communicated them to the author.

Mechanics' Lyceum.

The annual course of exercises of this Society was commenced on Tuesday evening last, at the Cowper Committee Room, by an Address by G. W. Light; which was an ingenious and well-written production, and well-fitted to the occasion.

Though the design of this Society does not admit of its being large, it furnishes a model on which hundreds of others, even in the city of Boston, might be formed, for the benefit of its members, and the intellectual and moral health of the city generally. All the members of the Mechanics' Lyceum gain some knowledge of science, which can hardly be said of any large society whose exercises are confined to lectures. An exceedingly small portion of the members of such societies do not make a *beginning;* they do not learn the *first letter* in the alphabet of Science. There is, however, a negative good in them. If they communicate no good, they prevent much evil. Hearing and seeing is worth something, but science is gained only by *acting*, by *mental action.*

Rail Road Journal,

A weekly quarto, under the above title, which, besides ably sustaining the character its name denotes, contains much useful information on internal improvements generally, and on various subjects of useful knowledge. Every American who is interested in internal improvement, (and who is not?) ought to have access to this valuable journal. It is published at 35 Wall-street, New York.

American Traveller.

This semi-weekly, which is already known in all the states, ought to furnish a part of the entertainment of every public house in the Union. It has already bestowed many favors upon travellers, and done much for the advancement of science. It is now upon its seventh volume, and is published and conducted by Messrs. Badger & Porter, Boston.

Goodrich's Universal Geography.

The prolific author of Peter Parley's entertaining and instructive books, has not confined his attention to the instruction of children, or to 18mo. pages. He has given to the public several larger works, and among them an Universal Geography, in a large octavo volume, which is filled with entertaining as well as useful knowledge. It is published by Messrs. Carter, Hendee & Co. Boston.

Geometry for Primary Schools.

We are glad to be informed by teachers, as we are from several states, that Geometry, aided by apparatus, is better calculated to teach children to *think*, to examine, compare, discriminate, and judge for themselves, than any other subject which they have presented to their minds. It is also the most entertaining subject, and is used as a reward to induce attention to other studies.

Mineralogy and Geology.

The lovers of science will be glad to be informed, that a book long needed is forthcoming from the press of Messrs. Clapp & Hull, Boston. It is a familiar and highly entertaining treatise on Mineralogy and Geology, by Miss Welch, who has already given to the public one or more useful works on Natural History. Having seen the manuscript and the proofsheets of this work, we are prepared to say, that it can hardly fail to be an entertaining and useful companion in every family where it is introduced, and that it ought to be a text-book in every school. It has the two characteristics which every book designed for children ought to have—it is both entertaining and instructive.

Circuit Schools.

Mr. Hall, of the Teachers' Seminary, and four of his assistants, are engaged in weekly schools in Andover & the vicinity. Their success is spoken of with the utmost satisfaction and confidence. That is as we expected. Indeed, collections of young people, (and old ones too,) once a week, for study and instruction in the useful branches, could hardly fail, under any circumstances, of producing very important results. It has ever appeared to us for years both singular and strange, that such a measure was not more generally appreciated, and more generally practised. Five thousand such schools at least, ought to be established in our country, within one or two weeks from this time, and continued through the winter, and not to be discontinued during the summer.

If the whole country should engage in some one, or a few subjects, and become acquainted with them during the present season, they would be prepared to unite in another, or others, at the commencement of the next season.

One subject which we should like to see taken up at a Circuit School in every village and neighborhood in the Union, during the present season, is *Letter Writing*, especially the mechanical part of it; such as the proper mode and place for the date, address, commencing of paragraphs, pointing, closing, signing, folding, sealing, and directing. On no subject, perhaps, is instruction so much needed; on none, probably, would a little assistance render such important aid.

A few lessons in *Practical Mensuration*, founded on the first lessons in Geometry, illustrated by apparatus, would undoubtedly be among the most useful and entertaining subjects that could be introduced at Circuit Schools.

Chloride of Lime.

Before chemistry improved the arts, cloth was bleached by spreading it in yards and fields, where it might be exposed alternately to moisture and the sun's rays. To do this with all the cloth made in a large manufacturing establishment, required several acres of ground. But since bleaching, with every other art, has been improved by science, more and better work is done in a few tubs and other vessels, in a few days than was formerly done in as many yards and fields, in weeks. The chemical agent which performs, with so much expedition and ease, this important operation in this very useful art, has been known by several different names. Without troubling our readers with the score of names applied to this substance in the early parts of its history, each of which it is worth twenty-five cents to pronounce, it may be remarked, that for a long time it was known by the name of oxymuriatic acid, from the belief among chemists, that it was muriatic acid with an additional portion of oxigen. But further experiments changed the opinion of chemists respecting the nature of this substance, and led them to believe, that instead of being muriatic acid, with another substance added, it was itself a simple substance; and from its color, which is a light green, it was called chlorine, which at present is the name commonly applied to it. The compounds of chlorine, (better chlorin,) with other substances, especially the earths and alkalies, are called chlorides, or, to those who prefer it, chlorids. Hence, the chlorid of lime, the chlorid of potash, &c.

The chlorid of lime was long known by the name of bleaching salts, as the chlorine in the combination was lodged there, and rendered safe and convenient for use, whenever it should be needed by manufacturers. As that name was rather too common for a substance used as a medicine, and especially as a tooth-powder, and as it is hardly safe to let our plain farmers and mechanics into the secrets of science, it was chloride of lime to the would-be scientific, and bleaching salts to those who made it, and understood its important uses. But the cholera, which has brought out innumerable secrets, has turned all the bleaching salts into the chloride of lime, whether used in factories, for preserving the teeth, or cleansing the streets.

Lectures for Teachers.

On Tuesday, the 8th of October, a Course of Lectures will commence at the Teachers' Seminary, Andover, by Mr. Hall, the Principal, for the benefit of Teachers, and the Conductors of Lyceums or Circuit Schools. Besides the lectures, which will continue two or three weeks, the ladies and gentlemen who attend them may unite in the exercises of the seminary, one for ladies, and the other for gentlemen. The price of the lectures will not be over a dollar, and the other expenses will be small, compared with the great benefit which the attendants, especially practical teachers, could not fail to derive from the course.

If five hundred or a thousand should attend, they could all find employment in schools or lyceums, the coming winter; and besides rendering their services doubly useful, they would be doubly remunerated for them.

We wish that ladies and gentlemen from all parts of the country, could receive the benefit of this course of lectures, and the other advantages offered by the seminaries which they might attend, and after being benefitted themselves, that they might diffuse their instruction, both in spirit and kind to all around them.

EXPERIMENTS.

chemistry.

A gentleman who had attended the meeting of a Lyceum, where he saw the properties of heat illustrated, dropped the crystal from his watch. After making many unsuccessful attempts to replace it, he recollected that he had heard and seen that heat expanded and cold contracted bodies; upon which he immersed the crystal in cold water, after which it was easily returned to its place.

If half a gill of sulphur be melted by heat, and suffered to cool in a small cup or other vessel, and when it is partially cool and solid, a thin pellicle being formed over the surface, the remainder be poured out, the interior will be completely coated with needle-shaped and beautiful crystals of sulphur. A similar process with several of the metals, will produce similar results.

intellects.

During the last season, several of the most business men in one of the most business towns in the vicinity of Boston, commenced a course of social instruction in the branches usually taught in schools, such as geography, grammar, geometry, &c. The result was, not only a thorough practical knowledge of the several subjects they undertook, but a high degree of satisfaction in acquiring it without any interruption in their business.

One of the most distinguished mathematicians and philosophers in the world at the present time, has acquired nearly the whole of his knowledge during the intermissions between other duties of a business character, which are more arduous than those devolving upon many individuals whose time and attention are exclusively devoted to them.

morals.

A child of five years old, who had attended an infant school in New York, took something that belonged to another child.—When called to an account by Mrs. Bethune, who is the soul of the infant schools in that city, she asked her how many commands he had broken. Two, he replied. Yes, you have broken three, says Mrs. B. No, I have not, Grandma'a, broke but two. She replied, you have told a lie, or borne false witness; you have stolen, and you have coveted your neighbor's goods. No, said the boy, I did not covet my neighbor's goods, I catched it up, and run away without thinking any thing about it.

Several gentlemen were conversing not long since, upon the subject of distilleries, when one of the number asked the others, who were gentlemen of great intelligence upon general topics, (not in morals,) that if a person should establish a distillery on a fair prospect of becoming independently rich, but with a certain knowledge that an hundred families would in consequence be made wretchedly poor, whether there would be any thing morally wrong in his proceeding. No, replied the gentlemen very promptly, the ruin of others would not be his lookout; he would not be to blame for the intemperance and poverty they brought upon themselves.

Which proposition in morals amounts to this, that it is right for one individual to make a hundred families poor, miserable, and wretched, for the purpose of making one person rich.

Readers will be able to compare, in the two cases here stated, the moral perceptions of adults with those of a child five years old

THE ARTS.

From the Cabinet Cyclopædia.

Ingredients employed in making Glass.

Under the general name of glass, chemists comprehend all mineral substances which, on the application of heat, pass through a state of fusion into hard and brittle masses, and which, if then broken, exhibit a lustrous fracture. Most glasses are transparent also; and the non-existence of this property is generally owing to the presence of some foreign and unessential substance.

The glass of commerce—that beautiful manufacture to which the generic name is most commonly applied—does not include so wide a range of bodies; and is always composed of some silicious earth, the fusion and vitrification of which has been occasioned by certain alkaline earths, or salts, and sometimes with the aid of metallic oxides.

There are five different and distinct qualities of glass manufactured for domestic purposes, viz.:

Flint glass, or crystal;
Crown or German sheet glass;
Broad or common window glass;
Bottle or common green glass; and
Plate Glass;

the materials and the processes used in making which, form the subject of our present inquiry.

Before commencing the description of any of the manipulations employed in this interesting manufacture, it will be better to give a general account of the different materials used, and to point out how the particular qualities of glass are influenced by the properties of those various ingredients.

Each of the five descriptions contains, in common with the others, two ingredients, which, indeed, are essential to their formation—silex and an alkali.

The variations of quality, and distinctive differences observable in glass, principally result from the kind of alkali employed, and its degree of purity, as well as from the addition of other accessory materials—such as nitre, oxide of lead or of manganese, white oxide of arsenic, borax, or chalk.

Silex is not equally proper in all its forms for the composition of glass. Sea sand, which consists of spherical grains of quartz, so minute, as to be qualified for the purpose without any preparation except careful washing, is the form wherein silex is most commonly used for the purpose in England. All sea sand is not, indeed, equally applicable to the glass-maker's purpose. That used in this country for making the finer descriptions of ware, is usually obtained, either from the port of Lynn, in Norfolk, or from Alum Bay, on the western coast of the Isle of Wight.

The best glass was formerly made with common flints, calcined and ground in the manner already described, as used in the manufacture of pottery, and hence the name which it acquired of flint glass. The employment of silex in this form is now wholly discontinued in glass-houses, as it is known that some qualities of sand answer the purpose equally well, while the labor and expense of calcining and grinding are saved by the substitution.

Both soda and potash are well adapted to the purpose of making glass. They are used in the form of carbonates, that is, holding carbonic acid in combination with themselves as bases.—The acid flies off during the progress of the manufacture, and the result is a compound of silex and alkali.

As already stated, the quality of glass is influenced by the degree of purity of the alkali.—For making the finest flint glass, pearlash, which is potash in a purer form, must be used. The alkali must previously be still further purified by solution and subsidence, and then evaporating the fluid to dryness. By this purification a loss is sustained, amounting to between 30 and 40 per cent. in the weight of pearlash. Coarser kinds of alkali, such as barilla, kelp, or wood-ashes, which are combined with many impurities, are employed for the production of inferior glass. Complete fusion and vitrification are accomplished by these means, the impurities even being of a nature to assist towards the production of these effects. The green color imparted to glass, is produced by the iron, which is present in a greater or less degree in these coarser alkaline substances. Barilla, when sufficiently cheap, is always chosen preferably to wood-ashes or kelp. The recent abatement of the import duty levied upon this article of commerce will, therefore, probably tend to the increased consumption of barilla in glass-houses.

A very small proportion of nitre is used in the composition of glass, to occasion the destruction of any carbonaceous matter which may exist in the ingredients. This salt must be added previous to the fusion of the glass. At a degree of heat much below that of the furnace, nitre will decompose, giving out much oxigen, and maintaining such metallic oxides as may be present in their highest state of oxigenation. It is thus of use in fixing arsenic, the volatile property of which increases as it approaches the metallic state.

Oxide of lead, in the form of either litharge or minium, is essential to the making of flint-glass, into the composition of which it enters very largely. This metal acts, in the first place, as a most powerful flux, promoting the fusion of all vitrifiable substances at comparatively low temperatures. It is also permanently beneficial in imparting highly valuable properties to the glass of which it forms a part. This, by its means, is rendered much more dense; has a greater power of refracting rays of light; possesses more tenacity when red-hot, causing it for that reason to be more easily worked; and is rendered more capable of bearing uninjured sudden changes of temperature. On the other hand, glass, into the composition of which much lead has entered, is so soft as to be easily scratched and injured if rubbed against hard bodies. Such glass is also improper as a recipient for many fluids which are of an acrid nature, by which it would be corroded and destroyed. Another great inconvenience attending the use of lead is this, that it does not become intimately enough united with the other components for the whole mass to assume an uniform density. It will almost always happen, that the glass at the bottom of the pot contains a larger proportion of litharge than that above. This inequality of density is continually increasing as the contents of the pot are diminished by the workman; and it is thence impossible to withdraw from it any two portions whose densities shall agree.*

Monsieur Guyton Morveau has related a very curious exemplification of this fact, which once occurred to himself when experimenting in conjunction with Monsieur de Buffon in the plate-glass manufactory near Langres. Remaining in the crucible was a portion of flint-glass in fusion, composed of thirty-two parts powdered crystal, thirty-two parts minium, sixteen of soda, and one part nitre. To this was added the requisite quantity of the ingredients commonly employed for forming plate-glass in the manufactory, and the whole was melted together in the furnace.—When the mass was sufficiently refined it was laded into the cistern, cast on the copper table in the usual manner, and transferred to the annealing furnace. Its quality being subsequently submitted to examination, the plate was found to be composed of two distinct and perfectly level strata through the whole mass, the lower stratum occupying about one third of its thickness.

So complete an instance of the precipitation of the denser through the lighter portion is not elsewhere to be met with in the records of glass-making: its occurrence in this particular occasion should probably be referred to the active agency of some cause which escaped the observation of the two philosophers.

It is a general effect of this inequality, that the glass, when wrought, appears waved; a defect which is particularly inconvenient in that which is intended for the construction of optical instruments. Glass is also fusible at lower temperatures according to the proportion of lead which it contains. This quality, which would be mischievous for some purposes, is, on the contrary, beneficial for others. It is often essential to chemists that they shall be able, during the progress of their experiments, to bend the tubes with which they are operating.

Black oxide of manganese has long been used for clearing glass from any foul color which it might accidentally possess through the impurity of the alkali employed, and in particular from that green tinge which marks the presence of iron. This property of manganese, when in the form of an oxide, occasioned it to be anciently known as *glass soap*, a name which very accurately describes its use. The circumstances attending the employment of this substance in glass-making, are of rather a curious nature. When added in a moderate proportion to any simple glass, it imparts a purple color; and should its quantity be much increased, this color is deepened until the glass becomes nearly black. If, while the mass thus colored is still in fusion, either white arsenic, or charcoal, or other carbonaceous matter, be added, an effervescence is seen to follow, and the color becomes gradually more faint until it altogether disappears, and the glass is rendered clear and transparent. Provided the green hue which it is desired to counteract be considerable, the application of a very small quantity of manganese is not followed by any sensible tinge of purple; but the moment that the proportion is more than sufficient for the purpose, this color immediately appears, and must be corrected.—This correction is performed in a very simple manner in the glass-house, by thrusting into the pot of melted glass a piece of wood, which, becoming charred by the heat, causes the purple again to vanish; while a slight effervescence as before described, and the escape of numerous bubbles of air, are plainly perceptible. If nitre be then added, the purple color will be restored.

The reason for these changes it is not difficult to explain. The oxide of manganese imparts a purple color, only when in a state of high oxigenation. When brought into contact with carbonaceous matter, it is partially deprived of its oxigen, and loses its coloring property. The air-bubbles which escape consist of carbonic acid gas, which is disengaged by the action of the charcoal on the oxide of manganese. The effect which follows upon the introduction of nitre is of a contrary nature. When made of a red heat this substance gives out oxigen in great abundance, and the manganese being thus reinvested with the oxigen of which it was deprived by the charcoal, resumes with it the coloring property.

Another advantage attending the use of oxide of manganese, results from its property of powerfully assisting in the fusion of earthy bodies. It also gives considerable density to glass, but the same disadvantage accompanies its use as already has been noticed with regard to litharge. Having from its greater specific gravity a tendency to settle towards the bottom of the pot, the glass by this means varies in density throughout its substance, in addition to which circumstance the manganese acts injuriously upon the pots by corroding them at the bottom.

One of the uses of white oxide of arsenic has already been described, that, namely, of correcting the coloring effects of manganese. It is also a very powerful flux, and a great temptation to its use is found in its cheapness. It should, however, be employed with moderation. If a considerable time be not allowed for its intimate incorporation with the other ingredients of the glass, this will appear clouded or milky; a fault which will afterwards increase with the lapse of time. An excessive quantity of arsenic likewise occasions the glass to become gradually soft and to decompose, for which reason the employment of drinking-vessels in this condition is unsafe.

Another, and a harmless, application of arsenic in glass-making is, when it is introduced into the fused mass in order to dissipate any carbonaceous matters which result from defects in preparing the alkali. In this case, small lumps of white arsenic are intimately blended with the mass by stirring. The great heat causes it at once to unite with and to carry off the carbon in a volatile form, leaving the glass entirely free from carbonaceous matter, and nearly so from arsenic.

Borax is used in preparing only the finest descriptions of glass: its employment is, indeed, principally confined to plate glass. It is too expensive to admit of its forming part in the composition of common descriptions, although its use in all cases would be desirable, as its efficacy in promoting the fusion of vitrifiable substances is unrivalled. When the borax has been introduced, the compound is caused by it to flow with great freedom, and to be without specks and bubbles, which would impair both its beauty and utility. Should the alkali employed prove deficient in strength, a small portion of this salt will serve as an effectual remedy.

Lime in the form of chalk is useful as a very cheap flux. It is also beneficial in facilitating the operations of the workman in fashioning glass, and it has the property of diminishing its liability to crack on exposure to sudden and great variations of temperature. Chalk can only be used sparingly, however, in the glass-house, as the escape of carbonic acid causes the ingredients in the pot to swell considerably during the fusion. The presence of lime in any excessive degree would also occasion the rapid destruction of the pots, upon the substance of which it acts with considerable energy. Glass wherein lime exists in excess is also rendered cloudy, although the mass while in fusion appears perfectly pellucid. Not more than about six per cent of lime can be added without risking this defect.

* Mr. Faraday has stated, in his paper on the manufacture of glass for optical purposes, which appeared in the Philosophical Transactions for 1830, that he found, on examining 'pots containing glass not more than six inches in depth, made from the usual materials, and retained at a full heat for twenty-four hours,' the following differences of specific gravity between the glass taken from the bottom and surface of the pots:

Top, 3.38 3.20 3.28 3.21 3.15 3.73 3.85 3.81 3.31 3.30
Bt'm. 4.04 3.77 3.85 3.52 3.80 4.63 4.74 4.75 3.99 3.74

COMMON THINGS.

AIR.

The manufacturers of soda water pour diluted sulphuric acid upon pulverized marble, and by that means produce a substance which they call fixed air. This is nearly twice as heavy as atmospheric air. Those who attempt to make an aerial voyage in a balloon, pour diluted sulphuric acid upon iron, by which an air is produced, thirteen times lighter than atmospheric air. Chemists sometimes heat nitrate of ammonia in a retort, and produce from it an air, which, when breathed, produces effects similar to intoxication. It has been called exhilarating gas. If oil, or rosin, or bituminous coal, be heated in a retort, it produces an air or gas, fit for lighting streets and dwellings.

If the oxid of manganese, common salt, and sulphuric acid, be mixed and heated, they produce an air which has a powerful effect upon colors, and is at present almost the only substance used for bleaching, especially in large factories. When this last air or gas is combined with lime, it forms the chloride of lime which is strewed about the streets of some of our cities so freely in this age of cholera.

Many other kinds of air might be mentioned; but these are sufficient to show that air is an indefinite term, and of itself can make no one but little wiser than before he heard of it.

Some of the names which have been applied to the different airs, are dephlogisticated air, mercurius calcinatus per se, empyreal air, dephlogisticated marine acid, oxigenized or oxigenated muriatic acid, inflammable air, chlorine, nitrous oxid gas, and numerous others equally elegant with those mentioned.

By referring back to the simple elements of nature, as mentioned in the previous numbers of the Lyceum, a person will readily understand the different kinds of air or gas which exist in nature or are formed by art. For although they are numerous, and represented by long and odd words, the elements which compose them are few, and easily understood and remembered.

The atmosphere, which is perhaps more commonly termed air than any other substance, is composed essentially, as has more than once been mentioned, of oxigen and nitrogen; though carbonic acid, hydrogen, carburetted hydrogen, and many other airs or gases, are either constantly or occasionally combined with those two.

Besides this view of the chemical ingredients of the atmosphere, its mechanical properties are of a most interesting character. Among the mechanical properties of the atmosphere or common air, its weight is perhaps the most striking and most important. The whole weight of atmosphere upon the earth, is about equal to a quantity of water sufficient to cover the whole of the earth's surface to the depth of thirty feet. And by considering the earth a globe 8000 miles in diameter, it is easy to calculate how many cubic feet or hogsheads of water would be equal in weight to the atmosphere upon its surface.

The weight of the atmosphere, like the weight of every other kind of matter, arises from the attraction of the earth upon it. By the weight of air, together with its penetrating nature, it finds its way into almost every other substance. Water contains it in large quantities, except for which fishes could not live in water. All vegetable substances, even the most solid oak, contain much of it. It is diffused through all animal matter. It is mixed with our blood, and circulates in our veins. It undoubtedly finds its way far into the depths of the earth, perhaps to its centre. It is hence evident that common air, besides covering the surface of the earth to the height of forty-five miles or more, is diffused through most other substances in the animal, vegetable and mineral kingdoms.

Common air not only spreads itself over the earth's surface, and penetrates to its centre, but it is constantly performing an infinite variety of operations, important to the happiness, and essential to the existence of every living acting being. It is constantly upon the march, from the equator to the poles, and from the poles to the equator. It is also passing from the land to the sea, and from the sea to the land, from mountains to valleys, and from valleys to mountains, either in the gentle breeze, the violent tempest, or the destructive tornado.

Nor are its moderate or its rapid marches, without their uses. Wherever and however it travels, it carries upon its wings, health, animation, fragrance, or some other blessing for the animal and vegetable creation, especially for man—for *stupid, ignorant, proud, self-flattered, unkind, ungrateful, unchristian man.*

QUESTIONS on LYCEUM No. 6.

What is the name of a solid enclosed entirely in parallelograms?

What is the specific name of a parallelopiped enclosed entirely by squares?

How many more solid inches in a two inch cube, than in a one inch cube? How many more in a four inch cube than in a two inch cube?

How many inches of surface does it require to enclose an inch cube?

How many solid inches in a four inch cube?

How many solid inches in the solid represented in figure 2?—also in figure 3?

How many inches of surface does it take to enclose a four inch cube?—also a parallelopiped, 8, 4, and 2 inches in dimensions—and one, 16, 2, and 2, as in figures 2 and 3?

If figure 4, in the last number of the Lyceum, represents a two inch cube, how many solid inches in it?—and how many inches will enclose it?; also figure 5.

What is the method of finding the contents of any parallelopiped?

How many solid inches in a common brick, which is 3, 4 and 2 inches in its dimensions?

How many solid feet in a stick of timber, 16 feet long, 2 wide, and 2 thick? [See fig. 3.]

How many cubic feet of water will a cistern hold, 4 feet deep, 4 long, and 4 wide?

How many solid yards in a block of granite, 8 yards long, 4 wide, and 2 thick?

How many solid feet of brick in a wall, 30 feet long, 20 high, and 2 thick?

How many solid yards of earth must be removed, to dig a canal 1000 yards long, 10 wide, and 2 deep?

Which are most expensive, state-prisons or infant schools, and which most likely to prevent crime?

How many self-supporting institutions might be established by what is expended in one year in Massachusetts for military trainings, and which would be the strongest protection to the Commonwealth?

Which communities accumulate the most wealth—those which spend much, or those which spend little, for churches and school-houses?

Which are most proper for instructing young children, books, or apparatus for visible illustrations?

Which is the cheapest for schools, apparatus, or books?

What two sciences give a description of the earth?

Which gives the names and situation of continents, islands and mountains, Geography or Geology? And which tells what continents, islands and mountains are composed of?

Which are the grandest of the sciences?

Which science is most simple and most easily learnt—Geography or Geology? Which gives the greatest interest and utility to our journies and our walks?

What science is best fitted to furnish amusement and healthful instruction to children?

What is best calculated to make children observing?

What science is calculated to acquaint farmers with the nature of their soils, and the best method of improving them?

What sciences are well calculated to lead the mind to Him who 'weighed the mountains in scales, and the hills in a balance?'